

This paper investigates the intricate relationships between multi faceted urban forms and carbon emissions, contributing to the ongoing debate on the sustainability impact of urban centralism versus decentralism in land-use strategies. To achieve this, we develop a multi dimensional core-periphery classification scheme and employ a combination of non-spatial and spatial models to analyze the non-stationary impacts of urban forms on carbon emissions. These comprehensive measures of urban forms respond to the "centralized" and "decentralized" views of spatial development, enriching the manifestation and quantification of these two theoretical arguments. In peripheral areas, adopting centralized strategies that prioritize economies of scale in land development and maintaining a moderate level of compactness can promote low-carbon sustainability. In core regions, centralized strategies of compactness increase carbon emissions, although this can be offset by enhanced connectivity, particularly within integrated metropolitan administration. Second, to reconcile the debates of these two theoretical views for better sustainable development, we focus on how local contexts matter for potentially shaping diverse impacts of different urban form strategies. The results further reveal that the influence of urban forms on carbon emissions varies spatially, contingent on economic, planning, and administrative factors across core and peripheral regions. Third, we further introduce a multifaceted core-periphery classification scheme to characterize the intricate impacts of urban forms based on local economic, planning, and administrative attributes. However, there are exceptions that specific peripheral eco-regions benefit from complexity while increased connectivity may undermine sustainability in less developed peripheries.